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(54) **Seal structure of gas turbine stationary blade shroud**

(57) A seal structure of gas turbine stationary blade shroud provides an improved seal plate having an enhanced sealing ability between mutually adjacent outer or inner shrouds in a turbine circumferential direction. A groove (12a, 12b, 22a, 22b) is provided in each of mutually opposing side faces along a turbine axial direction of mutually adjacent shrouds (11a, 11b, 21a, 21b) in the turbine circumferential direction and a seal plate (1) of thin plate shape is disposed with its each bent portion (1a, 1b) being inserted into the groove. The bent portion has a width which is slightly larger than that of the groove and is flexibly deformable to be inserted into the groove. The bent portion, being pressed down and inserted into the groove, is fixed in the groove by a spring effect. The seal plate partitions a gas flow passage (40) and a cooling air introducing passage on a turbine casing side of the outer shrouds (11a, 11b). There is caused no gap between the groove and the seal plate due to thermal deformation of the shrouds and sealing ability can be enhanced.

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Description

BACKGROUND OF THE INVENTION:

Field of the Invention:

[0001] The present invention relates to a seal structure of gas turbine stationary blade shroud, and more specifically to a seal plate of improved shape which is able to enhance a sealing ability between mutually adjacent shrouds.

Description of the Prior Art:

[0002] Fig. 3 is a perspective view showing general arrangement of stationary blades, outer shrouds and inner shrouds in a gas turbine. In the figure, numerals 10a and 10b designate stationary blades which are mutually adjacent in a turbine circumferential direction, numerals 11a and 11b designate outer shrouds which are mutually adjacent in the same circumferential direction and numerals 22a and 22b designate inner shrouds which are mutually adjacent in the same circumferential direction. Numeral 12a, 12b designates a groove provided in each of side faces along a turbine axial direction of the outer shroud 11a, 11b, respectively, and numeral 22a, 22b designates a groove provided in each of side faces along the same axial direction of the inner shroud 21a, 21b, respectively. Numeral 40 designates a gas flow passage of a high temperature combustion gas. In order to form and seal the gas flow passage 40 and a cooling air introducing passage leading to interiors of stationary blades 10a and 10b, there is provided a seal plate, to be described hereinafter, each between the grooves 12a and 12b of the mutually adjacent outer shrouds 11a and 11b, as described above, and between the grooves 22a and 22b of the likewise described inner shrouds 21a and 21b. The seal plate is not shown in Fig. 3 for simplicity of illustration.

[0003] In the gas turbine stationary blades constructed as shown in Fig. 3, one stationary blade and its outer shroud 11 and inner shroud 21 together with adjacent one stationary blade and its outer shroud and inner shroud provided the gas flow passage 40 formed therebetween.

[0004] Fig. 2 is a perspective view of a prior art seal structure using said seal plate of gas turbine stationary blade shroud and, as shown there, there is provided the groove 12a, 12b in each of the mutually opposing side faces along the turbine axial direction of the mutually adjacent outer shrouds 11a and 11b and the seal plate 30 of thin plate shape is disposed with its each end portion being inserted into the groove 12a, 12b, so that the gas flow passage 40 and the cooling air introducing passage on an outer side of the outer shrouds 11a and 11b are partitioned and sealed between each other. It is to be noted that there is disposed also a seal plate of like shape between the grooves 22a and 22b of the inner shrouds 21a and 21b, as mentioned above, and air on an inner side of the inner shrouds 21a and 21b is prevented from flowing into the gas flow passage 40 as well as the high temperature combustion gas is prevented from flowing into the inner side of the inner shrouds 21a and 21b.

[0005] Cooling air, not shown in the figure, is introduced from the cooling air introducing passage on the outer side, that is, on a turbine casing side, of the outer shrouds 11a and 11b into cooling air passages provided in the interiors of the stationary blades 10a and 10b and, after having cooled the blades, is discharged into the gas flow passage 40. Also, sealing air is introduced from the outer shrouds 11a and 11b into the stationary blades 10a and 10b to be further supplied into cavities, not shown, in the inner shrouds 21a and 21b, so that the inner side of the inner shrouds is made in a higher pressure than that of the high temperature combustion gas so as to be sealed.

[0006] In the stationary blade shroud portion of gas turbine as mentioned above, there is formed the cooling air introducing passage. But, because the pressure of the cooling air is higher than that of the main gas and also the sizes of the inner shrouds and the outer shrouds are comparatively large, there occurs thermal deformation in the inner shrouds and the outer shrouds due to thermal gradient therein while in operation. Thus, at the portion where the seal plate 30 is inserted into the groove 12a, 12b, there occurs thermal deformation to cause a gap and no little portion of the cooling air does not flow into the stationary blade 10a, 10b but leaks into the main gas flow passage side.

[0007] Further, when the seal plate is to be assembled into the shrouds, because the space between the mutually adjacent side faces of the shrouds is narrow, it is considerably difficult to insert the seal plate, which is rigid, into the grooves in both of the side faces.

SUMMARY OF THE INVENTION:

[0008] In order to dissolve said problems in the prior art, it is an object of the present invention to provide an improved seal structure of gas turbine stationary blade shroud in which a seal plate is given a spring effect to be flexible against thermal deformation of a groove of shroud into which the seal plate is inserted, to thereby enhance a sealing ability and also the seal plate can be easily assembled into the groove of shroud.

[0009] For attaining said object, the present invention provides the following means:

(1) A seal structure of gas turbine stationary blade shroud comprising a seal plate of thin plate shape disposed with its each end portion being inserted into a groove, said groove being provided in each of mutually opposing side faces along a turbine axial direction of mutually adjacent stationary blade shrouds in a turbine circumferential direction, char-

acterized in that each said end portion of the seal plate comprises a bent portion of which width in a turbine radial direction is larger than that of said groove and said bent portion is flexibly deformable so as to be inserted into said groove and, once inserted, is fixed in said groove by a spring effect.

(2) A seal structure of gas turbine stationary blade shroud as set forth in (1) above, characterized in that said bent portion has a length in the turbine circumferential direction which is smaller than a depth of said groove so that a bent end portion thereof may not protrude beyond a surface of said groove.

[0010] In the seal structure according to the invention of (1) above, the seal plate has a bent portion at its each end portion, said bent portion being bent in a semi-circle, for example, and having a width of bent shape in the turbine radial direction which is slightly larger than a width of the groove provided in each of the side faces of the shrouds. By inserting such bent portion into the groove, there is caused no gap between the groove and the seal plate by the spring effect at the end portions of the seal plate and sealing ability can be enhanced.

[0011] Also, the seal plate is made thinner than the prior art seal plate and both end portions thereof have spring effect, thereby even if there occurs a thermal deformation of the groove, the seal plate can respond flexibly to that deformation so as not to cause a gap and there acts no unreasonable force due to rigidity of the sealing portion.

[0012] In the seal structure according to the invention of (2) above, the bent portion of the seal plate has such a limited bent end portion as only to be inserted into the groove, thereby work of the seal plate becomes facilitated.

[0013] Further, because the space between the mutually opposing side faces of the stationary blade outer or inner shrouds is narrow, while it has been considerably difficult and taken much time to insert the rigid seal plate into the groove in the prior art, according to the seal structure of the invention of (1) and (2) above, the bent portion of the seal plate can be deformed so as to be easily inserted into the groove, hence assembling work of the seal plate into the sealing portion becomes much facilitated.

BRIEF DESCRIPTION OF THE DRAWINGS:

[0014]

Fig. 1 is a view showing a seal structure of gas turbine stationary blade shroud of one embodiment according to the present invention, wherein Fig. 1(a) is a perspective view, Fig. 1(b) is a view showing one example of shape of seal plate bent portion and Fig. 1(c) is a view showing another example of shape of seal plate bent portion.

Fig. 2 is a perspective view of a prior art seal structure of gas turbine stationary blade shroud.

Fig. 3 is a perspective view showing general arrangement of stationary blades, outer shrouds and inner shrouds in a gas turbine.

DESCRIPTION OF THE PREFERRED EMBODIMENTS:

[0015] An embodiment according to the present invention will be described concretely below with reference to the figure. Fig. 1 is a view showing a seal structure of gas turbine stationary blade shroud of one embodiment according to the present invention, wherein Fig. 1(a) is a perspective view, Fig. 1(b) is a view showing one example of shape of seal plate bent portion and Fig. 1(c) is a view showing another example of shape of seal plate bent portion. In Fig. 1(a), numerals 11a and 11b designate mutually adjacent outer shrouds and a groove 12a, 12b is provided in each of both side faces along a turbine axial direction of the outer shrouds 11a and 11b, respectively. In Fig. 1(a), these parts are shown using same numerals as those in the prior art example of Fig. 2.

[0016] Width of the groove 12a, 12b in a turbine radial direction is shown by t and a seal plate 1 is disposed with its each bent portion 1a, 1b being inserted into the groove 12a, 12b, respectively. The seal plate 1 is made of a plate which is thinner than the prior art seal plate 30 and its each end portion is worked to form the bent portion 1a, 1b, which is given a flexibility by a spring effect and is inserted into the groove 12a, 12b, respectively, to be fixed therein by the spring effect, as shown in Fig. 1(a).

[0017] The bent portion 1a, 1b of the seal plate 1 is worked so as to have a width t' in the turbine radial direction which is slightly larger than the groove width t and when the bent portion 1a, 1b is to be inserted into the groove 12a, 12b, it is pressed down so as to meet the groove width t for easy insertion and, once inserted, it is fixed in the groove 12a, 12b by restoring force of the spring effect.

[0018] Also, according to another embodiment of the seal plate as shown in Fig. 1(c), the bent portion 1a, 1b is worked so as to have an opening end portion width t' which is slightly larger than the groove width t, like the above-mentioned embodiment, and when the bent portion 1a, 1b is to be inserted into the groove 12a, 12b, it is likewise pressed down and inserted to be fixed in the groove 12a, 12b.

[0019] Further, the bent portion of the seal plate may have a length in the turbine circumferential direction which is smaller than a depth of the groove so that a bent end portion thereof may not protrude beyond a surface of the groove, as shown in Fig. 1(a). In this case, the bent portion of the seal plate has such a limited bent end portion as only to be inserted into the groove, thereby work of the seal plate becomes facilitated.

[0020] It is to be noted that the example of Fig. 1 has

been described with respect to the example where the seal plate 1 is fitted to the outer shrouds 11a and 11b, but the seal plate 1 is also fitted in a groove 22a, 22b of inner shrouds 21a and 21b, respectively, and description therefor, being same as in Fig. 1, is omitted.

[0021] According to the seal structure as described above, the bent portion 1a, 1b of each end portion of the seal plate 1 is fitted in the groove 12a, 12b so as to function to give a spring effect in the groove, thereby occurs no gap between the seal plate 1 and an inner wall face of the groove 12a, 12b and sealing ability can be enhanced.

[0022] Also, the seal plate 1 can be made thinner than the prior art seal plate 30 and each end portion thereof is worked so as to have flexibility, thereby a flexible response to the thermal deformation of the groove can be attained by the spring effect and there acts no unreasonable force due to rigidity of the sealing portion.

[0023] Further, even in a narrow space between the mutually adjacent shrouds, the seal plate 1 can be easily inserted into the groove 12a, 12b, so that assembling of the sealing portion becomes much facilitated.

[0024] The invention is not limited to the particular construction and arrangement herein illustrated and described but embraces such modified forms thereof as come within the scope of the following claims.

Claims

1. A seal structure of gas turbine stationary blade shroud comprising a seal plate (1) of thin plate shape disposed with its each end portion being inserted into a groove (12a, 12b, 22a, 22b), said groove being provided in each of mutually opposing side faces along a turbine axial direction of mutually adjacent stationary blade shrouds (11a, 11b, 21a, 21b) in a turbine circumferential direction, characterized in that each said end portion of the seal plate comprises a bent portion (1a, 1b) of which width in a turbine radial direction is larger than that of said groove and said bent portion is flexibly deformable so as to be inserted into said groove and, once inserted, is fixed in said groove by a spring effect.

2. A seal structure of gas turbine stationary blade shroud as claimed in Claim 1, characterized in that said bent portion (1a, 1b) has a length in the turbine circumferential direction which is smaller than a depth of said groove (12a, 12b, 22a, 22b) so that a bent end portion thereof may not protrude beyond a surface of said groove.

Fig. 1(a)

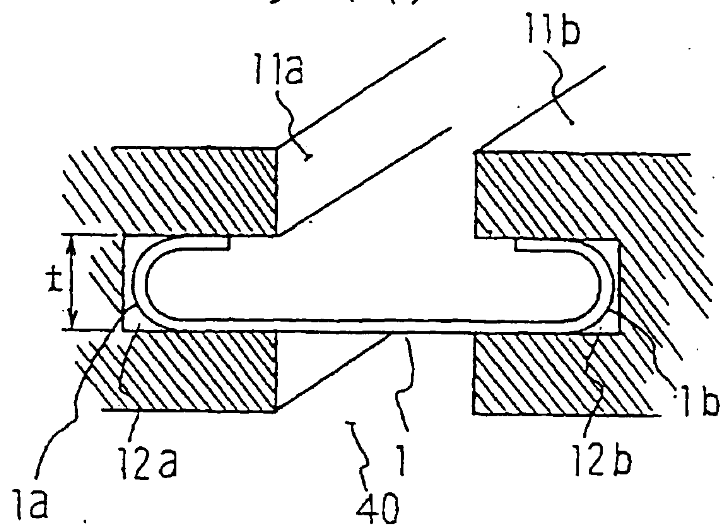

Fig. 1(b)

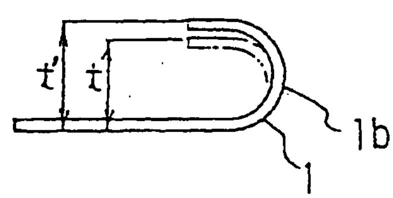

Fig. 1(C)

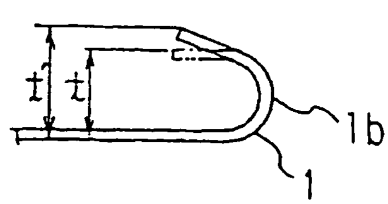

Fig. 2

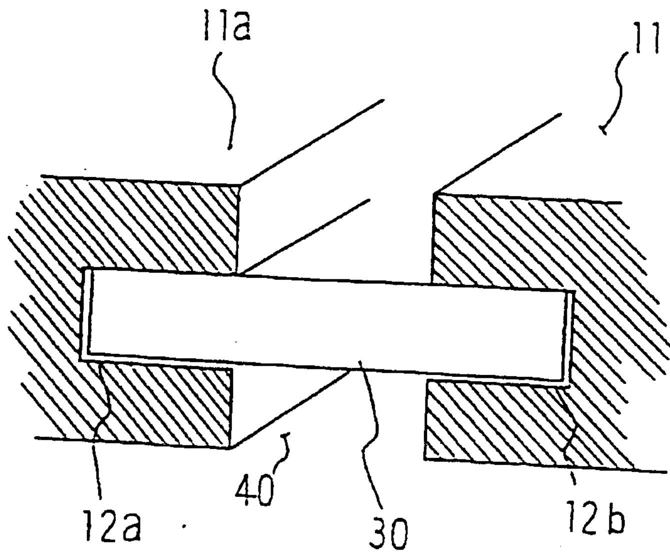

Fig. 3